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Information Science and Technology Center Seminar Series

Claire Monteleoni
Center for Computational Learning Systems
Columbia University

"Tracking Climate Models: Advances in Climate Informatics"

Wednesday, February 16, 2011
3:00 - 4:00 PM
TA-3, Bldg. 1690, Room 102 (CNLS Conference Room)

Abstract: Climate models are complex mathematical models designed by meteorologists, geophysicists, and climate scientists, and run as computer simulations, to predict climate. There is currently high variance among the predictions of 20 global climate models that inform the Intergovernmental Panel on Climate Change (IPCC). Given temperature predictions from 20 IPCC global climate models, and over 100 years of historical temperature data, we track the changing sequence of which model currently predicts best. We use an algorithm due to Monteleoni and Jaakkola, that models the sequence of observations using a hierarchical learner, based on a set of generalized Hidden Markov Models (HMMs), where the identity of the current best climate model is the hidden variable. The transition probabilities between climate models are learned online, simultaneous to tracking the temperature predictions.

On historical global mean temperature data, our algorithm's average prediction loss nearly matches that of the best performing climate model in hindsight. Moreover its performance surpasses that of the average over climate model predictions, which is the default practice in climate science, the median prediction, and least squares linear regression. We also experimented on climate model predictions through the year 2098. Simulating labels with the predictions of any one climate model, we found significantly improved performance using our algorithm with respect to the other climate models, and techniques. Drilling down on Africa, Europe, and North America, on historical data, at both annual and monthly time-scales, and in future simulations, our algorithm typically outperforms both the best climate model per geographical region, and linear regression, and consistently outperforms the average climate model prediction, the benchmark.

This talk is based on joint work with Gavin Schmidt (NASA Goddard Institute for Space Studies and Columbia University Earth Institute), Shailesh Saroha, and Eva Asplund (Computer Science, Columbia University).

Biography: Dr. Claire Monteleoni is research faculty in the Center for Computational Learning Systems, and adjunct faculty in the Department of Computer Science, at Columbia University in the City of New York. Prior to joining Columbia, she was a postdoc in Computer Science and Engineering, at the University of California, San Diego. She completed her PhD in 2006 and her Masters in 2003, in Computer Science, at MIT. She did her undergraduate work, in Earth and Planetary Sciences, at Harvard University. Her research has focused on Machine Learning theory and algorithms, in particular: learning from data streams, clustering, active learning, and privacy-preserving machine learning. She has also recently been working on Climate Informatics: accelerating discovery in Climate Science with Machine Learning. Her work in this area has received a Best Application Paper Award, and has been presented at an Expert Meeting of the Intergovernmental Panel on Climate Change (IPCC), a panel formed by the UN, that shared the 2007 Nobel Peace Prize.

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Contact the technical host Frank Alexander, fja@lanl.gov, 665-4518 for further information.
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